

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Alessio Miliani et al
Title: Assembly System of a Thermocouple For a Gas Turbine
Serial No.: filed concurrently
Art Unit: n/a
Filing Date: filed concurrently
Examiner: n/a
Date: June 21, 2006

INFORMATION DISCLOSURE STATEMENT

Mail Stop Patent Application
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

The following are submitted in the above application in compliance with 37 CFR 1.97 and 37 CFR 1.98.

- [X] 1. A list of documents on Form PTO-1449 or Substitute together with copies of each identified document (other than U.S. patents and U.S. patent application publications unless required by the Office) and a translation thereof or a concise explanation of each non-English language document or a Search Report or communication from a non-US patent office or an International Search Report from an International Searching Authority for a patent application filed via the Patent Cooperation Treaty or document(s) cited in the application or the priority application.

This paper is submitted in accordance with:

- [X] 2. 37 CFR 1.97(b): [within three months of national, non-CPA filing, prior to first Office Action, on the merits, or prior to first office action after filing an RCE]

- [] 3. 37 CFR 1.97(c): [before Final Office Action, Allowance, or other action closing prosecution, whichever is earlier]; and

[] a. The required Certification made in Item 5 below; or

[] b. The \$180.00 fee specified in 37 CFR 1.17(p) for submission of this Information Disclosure Statement is authorized in item 6 below.

- [] 4. 37 CFR 1.97(d): [on or before issue fee payment]; and

a) The required Certification is stated in item 5 below; and

b) The \$180.00 fee specified in 37 C.F.R. 1.17(p) for submission of this Information Disclosure Statement is authorized in item 6 below.

[] 5. Certification

- [] a. Each item of information contained in this Statement was first cited in any communication from a foreign patent office in a counterpart foreign patent application not more than three months prior to the filing of this Statement; or
- [] b. No item of information contained in this Statement was cited in a communication from a foreign patent office in a counterpart foreign patent application and, to the knowledge of the person signing this document after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in 37 CFR 1.56(c) more than three (3) months prior to the filing date of this Statement.

[X] 6. Payment of all applicable fees:

- ☒ Please charge all applicable fees associated with the submittal of this Information Disclosure Statement to Deposit Account No. 090470.
- ☐ Enclosed is a check in the amount of \$_____ in payment of all applicable fees associated with the submittal of this Information Disclosure Statement.

This document is submitted in duplicate.

Respectfully submitted,



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Substitute for form 1449PTC

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Complete if Known

Application Number	
Filing Date	
First Named Inventor	Alessio Millani
Art Unit	
Examiner Name	
Attorney Docket Number	72NP154554

U. S. PATENT DOCUMENTS

[illegible]

FOREIGN PATENT DOCUMENTS

[illegible]

Examiner Signature		Date Considered	
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EXAMINER: Initial reference considered, whether or not citation is in conformance with MPEP 909. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹Applicant's unique claim designation number (optional). ²See MPEP 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or maintain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.94. This collection is limited to a time 2 hours is complete, including gathering, preparing, and submitting the completed application form to the USPTO. There will very depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 61241633

PUBLICATION DATE : 27-10-86

APPLICATION DATE : 19-04-85

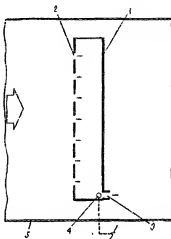
APPLICATION NUMBER : 60083701

APPLICANT : MATSUSHITA ELECTRIC IND CO LTD;

INVENTOR : GOTO YUICHI;

INT.CL. : G01K 13/02 F24F 11/02 G01N 25/64

TITLE : DETECTOR



ABSTRACT : PURPOSE: To detect average property of fluid by letting the fluid flowed in from plural inflow ports of a fluid duct flow out from an outflow port utilizing pressure difference and detecting property of the fluid by a detecting element provided near the outflow port.

CONSTITUTION: The device is provided with a fluid duct 1, plural inflow ports 2 provided opposite to the flow and an outflow port opened in the direction of the flow, and a detecting element 4 is provided near the outflow port. As the pressure of the inflow port 2 is opposite to the direction of flow, it becomes higher than that of the outflow port by the value of dynamic pressure of the flow. Accordingly, air flowed in from plural inflow ports by pressure difference is mixed in the duct 1, and even if temperature of the air at inflow ports is different, it becomes an average state of temperature near the outflow port, and discharged from the outflow port 3. Consequently, by installing a detecting element 4 at this position, average temperature can be detected easily by a detecting element.

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PATENT SPECIFICATION

784,597



Date of Application and filing Complete Specification: Aug. 22, 1955.

No. 24181/55.

Application made in United States of America on Aug. 23, 1954.

Complete Specification Published: Oct. 9, 1957.

Index at acceptance:—Class 40(1), N3A1.

International Classification:—G08c.

COMPLETE SPECIFICATION

Improvements in or relating to Gas Temperature Sensing Unit or Probe of Thermocouple Type

We, JOHN HENRY CANTLIN and ERIC
ERNEST ANDERSON, citizens of the United
States of America, of 30 Byron Road, Short
Hills, State of New Jersey, United States of
America, and at 53 Masonic Street, Need-
ham Heights, Commonwealth of Massachu-
setts, United States of America, do hereby
declare the invention, for which we pray that
a patent may be granted to us, and the method
by which it is to be performed, to be particu-
larly described in and by the following state-
ment:—

This invention relates to gas temperature
sensing units or so-called probes of the thermo-
couple type. An object of the invention is to
prolong the useful life of such devices, particu-
larly as applied to vibration-subject installa-
tions, as in the operative control of jet engines
and gas turbines, by providing therefor means
to damp and suppress vibration amplitude,
and accordingly markedly improving the
resistance to mechanical failure under vibra-
tion of, and associated with, the probe and its
mount.

According to the invention there is provided
a gas temperature probe assembly of the
thermocouple type, comprising an elongated
probe body supporting and insulating thermo-
couple wires which form a thermocouple junc-
tion, and a supporting member adapted for
rigid mounting and having a through bore
receiving one end portion of the probe body,
the bore having at the portion thereof toward
the junction end of the probe body a concen-
tric flaring mouth through which the probe
body freely projects and which is arranged to
afford, at the open mouth end, substantial
freedom for vibratory movement to the radi-
ally opposite portion of the probe.

In the drawings illustrating one embodiment
of the invention:

Figure 1 is a side elevation and longitudinal
section of a gas temperature probe assembly,
on an enlarged scale at least about twice full
size for an average device;

Figure 1A similarly shows a probe tip
portion without an impact head about the
thermocouple junction;

Figure 1B similarly shows another form of
probe tip portion; and

Figure 2 is a further sectional enlargement
of the basal or mounting portion of the probe
of Figure 1.

A sensing unit or probe of the invention
comprises a tubular body or shield 3 having
at the free end an impact head 4 rigidly
united with the tube as by a circular helium
arc weld as at 5. The head is closed at the
free end to provide a gas trapping chamber
within it. It has a relatively large inlet 6 to
face into the high-velocity flow of the gas
subject to investigation, and a relatively minute
vent 7 spaced axially from the inlet 6 and
centrally positioned with respect thereto. In
Fig. 1 the vent is shown dotted, being directly
behind and substantially hidden by the thermo-
couple junction 10. It is to be understood,
noting Figs. 1A and 1B again referred to later,
that temperature probes of the class concerned
may individually differ in various respects such
as construction and arrangement for the inner
end or tip portion, which latter may or may
not include an impact head more or less en-
closing the thermocouple junction such as the
thermocouple junction 10 of the drawings.

The present invention is useful generally with
any such probe unit.
A probe as here constructed is adapted for
insertion into a duct through which flows gas
usually at high temperatures, velocities and
pressures, as in the case of the tail pipe or
tailcone of a jet engine or gas turbine. Part
of a wall of such duct is shown dotted at W
in Fig. 1, wherein the assumed direction of
gas flow is perpendicular to the sheet and
away from the viewer. It will be understood
that gas of the stream enters and is trapped
in the impact head and is more or less stag-
nated and caused to follow a tortuous path
in escaping through the vent 7.

[Price

In other words, the amplitude of vibration as designated by the transverse arrow C is less than or does not exceed the total flare at the mouth of the bell; that is, one-half the vibratory amplitude is accommodated by the flare at the upper portion of Fig. 2 and the other half by that at the lower portion. The internal curve or line of flare 25 for the bell-mouth portion b may otherwise be defined as an exponential curve, one factor in the equation for which is a radius tangential to the tube at the base of the flared portion b and at the junction thereof with the straight cylindrical bore of portion a.

It will be noted further that the sleeve portion 23 of the mount is of substantial thickness at the portion a, substantially exceeding the metal wall thickness of the probe tube 3 and that, at the opened flared end of the bell portion b, the sleeve wall thickness is still at least substantially equal to the probe tube wall thickness.

As a result of the bell-mounted mount 20 the vibratory action of the probe tube 3 is damped or suppressed progressively along the tube from the open end toward the base of the flare portion b of the mount and in such fashion that at the plane A and thence on through the portion a thereof, the vibration is approximately zero. Consequently the probe support does not terminate abruptly at the inner face of the wall W of the gas duct. Resultantly the heretofore experienced mechanical failure, cracking or rupture at that region is greatly reduced or practically eliminated.

Turning now to the exterior of the mount 20, the intermediate anchor portion 21 has a reduced inner part 27 to receive a mounting flange 30 fitted tightly thereon and welded to it as at 31. The larger shoulder or outer part 28 of said anchor 21 abuts the outer face of the mounting flange 31 and has the outer collar 22 formed integrally with it.

In the construction of the probe and the mount there is provided for each thermocouple wire 8 and 9 a connection post 12, 13 formed with a central bore through which the wires are passed fully to the outer end where each

is trimmed above the respective post and welded to it. Where the probe is of a grounded type only one connector post may be needed; in other instances the thermocouple circuits may involve three or more wires, in which case

a like number of posts is provided. The inner ends of the posts such as 12, 13 are formed with retaining heads 12a, 13a, and the posts are externally threaded for reception of washers and anchor nuts 12b, 13b. The inner portions of the posts and including a portion of the threading thereof are cast into or extended through a molded mass or block 14 of electrically insulating ceramic material, porcelain or the like. The block 14 and the posts are so dimensioned lengthwise of the

probe and the post threading is of such extent that it extends into the ceramic 14 for one or more turns, for firm anchorage. Said ceramic block 14 is formed to fit in the outer collar portion 22 of the probe mount 20 and has an inner peripheral portion to seat against the outer face of the shoulder part 28 of the mount. The outer end of the post-holding ceramic body 14 is reduced to present an inclined annular shoulder between it and the larger inner or base portion, as seen in Fig. 1. In the assembly of the probe device the one or more connection posts such as 12, 13 and the post-holding ceramic block 14 are inserted as a unit into the mount collar 22. The outer peripheral marginal portion 22a is then turned over the shouldered inner portion of the post block 14 after first interposing between the shoulder and the inner turned flange 22a automatic means for compensating for positional change and stress variation as between the mount 20 and the post block 14 by reason of differential thermal expansion between these parts. Said means comprises at least one annular compensator member or ring 15 shaped and dimensioned for reception between the generally radial but preferably inclined shoulder of the ceramic block 14 and the metal of the flange 22a of the mount collar 22. Such compensator ring 15 is fashioned from a spring steel or ferrous alloy such as Inconel and Invar (both Registered Trade Marks), and has a formation such that the difference in thermal expansion between ceramic block 14 which it directly abuts and the metal parts of the mount 20 is compensated for and will preserve at all times a firm and substantially vibration-free tight juncture for the assembled parts throughout the entire expected range of associated operational temperatures. In some instances, more than one such compensator ring may be used or alternatively, as illustrated, a second or filler annulus 16 may be employed for assured engagement and sealing of the parts, such additional washer-like member 16 being located outside the compensator ring 15, between it and the mount flange 22a. Said additional annulus 16 if employed need not be of the special composition as for the compensator ring 15 and may, for example, be of an ordinary or relatively soft steel.

A further step in the assembly of the probe and mount is that of filling any remaining cavity within the mount and the inner end of the tube 3 and between the latter and the inserted post-holder block 14. This is accomplished by pressure-filling with a ceramic or cementitious material in plastic state. For this purpose the mount is provided with a pressure-fill aperture 21x admitting to the interior of the mount and herein formed through the intermediate body or anchor portion 21 thereof. The interior of the mount is thus

completely and solidly filled, under appropriate pressure, and the filling port 21x sealed off by the filling material itself or otherwise, so that upon setting the entire probe and mount assembly is structurally integrated and resistant to vibrational effects.

The assembled probe unit, including the tube 3, the tube base or mount 20 and the attaching flange 30 are designed for installation on a gas flow wall W such as that of a jet turbine mentioned. It will be understood that the given wall adjacent which gas temperatures are to be measured is apertured for insertion of the "bell-mouth" probe mount sleeve 22, preferably leaving at least a slight interspace between them. The attaching flange 30 of the mount 20 in the illustrative example has bolt-mounting holes 32 diametrically spaced to opposite sides of the axis of the probe and in a plane accurately normal to the axis of the gas vent 7 and hence also to the direction of gas flow. In other words, the diametral plane containing the center line of the bolt holes 32 for the mounting flange is angularly spaced 90° from the gas vent 7 as shown in the illustrated mount 20. While this is generally preferable, the bolt holes 32 can also be arranged at any other angle in respect to vent 7 in order to facilitate specific mounting requirements.

What we claim is:—

1. A gas temperature probe assembly of the thermocouple type, comprising an elongated probe body supporting and insulating thermocouple wires which form a thermocouple junction, and a supporting member adapted for rigid mounting and having a through bore receiving one end portion of the probe body, the bore having at the portion thereof toward the junction end of a probe body a concentric flaring mouth through which the probe body freely projects and which is arranged to afford, at the open mouth end, substantial freedom for vibratory movement to the radially opposite portion of the probe.

2. A probe assembly according to claim 1, wherein the supporting member has a sleeve and a mounting flange, said sleeve having a straight cylindrical bore portion directly receiving one end of the probe with a press fit and having, in longitudinal continuation of the cylindrical bore portion, the flaring mouth the inner wall of which is tangential to the conjoined end of the cylindrical bore portion.

3. A probe assembly according to claim 2, wherein the sleeve has a relatively thick wall as compared with the probe wall and the mouth flares away from the mounting flange in such a manner that the expectable overall vibrational amplitude for the probe body is accommodated by the flare.

4. A probe assembly according to claim 2 or claim 3 wherein the supporting member comprises a generally cylindrical body having the sleeve at one end in continuation of an

intermediate anchor portion carrying the mounting flange and an outer collar portion at the other end housing electrical connections for the thermocouple, the straight cylindrical bore portion in the sleeve being continued through said anchor portion.

5. A probe assembly according to claim 4, wherein the outer collar portion contains a filling of electrically insulating ceramic material for mounting the electrical connections for the thermocouple, the collar including an insulated outer marginal portion, and annular spring means between the ceramic mass and the insulated portion to compensate for thermal expansion differential between said ceramic mass and insulated portion.

6. A probe assembly according to claim 5 wherein the electrical connections for the thermocouple comprises an externally threaded tubular binding post for thermocouple wire connection, the post having an inner portion including a part of the threading embedded in the ceramic mass and an outer portion projecting therefrom, and a thermocouple wire extending outwardly through said mass and the tubular post and conductively bonded thereto at the outer end.

7. A probe assembly according to claim 5 or 6, wherein the spring means comprises a spring metal compensator ring between the ceramic mass and said insulated portion constructed and arranged to compensate for thermal expansion differential between the mass and the collar so as to afford tight juncture of the parts at all times.

8. A probe assembly according to any one of claims 1 to 7, wherein the thermocouple junction is housed in an impact head.

9. A probe assembly according to any one of claims 1 to 7, wherein the thermocouple junction is housed in a sampling head.

10. A probe assembly according to any one of claims 1 to 7, wherein the thermocouple junction is exposed.

11. A gas temperature probe assembly of the thermocouple type having its parts constructed, arranged and adapted to operate substantially as described with reference to the accompanying drawings.

12. Method of manufacturing and assembling gas temperature probes of the thermocouple type having an elongate conductor-carrying body with an outer mounting end, an intermediate portion and a projecting junction or free end, comprising the steps of providing in a mounting member a bore having a straight longitudinal axis, a concentric cylindrical portion and a flaring mouth, and fitting the outer mounting end of the probe body in a firm seating position in the cylindrical bore portion with the intermediate portion extending freely through substantially the entire length of the flaring mouth and with the junction end of the probe body projecting therebeyond.

13. Method according to claim 12, includ-

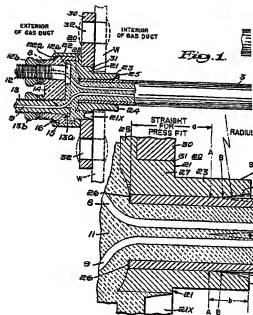
ing fastening one or more thermal compensator spring metal rings and disposing the same between axially opposed probe tube mounting members having differential thermal expansion, and selecting the component metal for the ring or rings so as to maintain for said members a firm and substantially vibration-free juncture at all times throughout the entire expected range of associated operational

temperatures.

14. Method of manufacturing and assembling gas temperature probes of the thermocouple type substantially as illustrated and described.

HASELTINE, LAKE & CO.,
28, Southampton Buildings,
Chancery Lane, W.C.2.,
Agents for the Applicants.

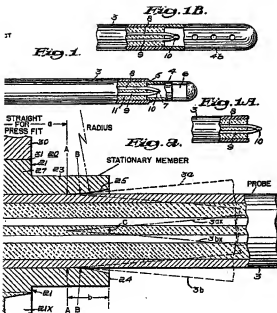
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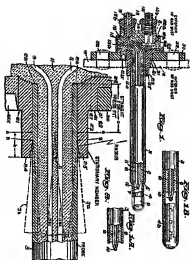


784,597 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.





784597 COMPLETE SPECIFICATION
1 SHEET
No. 4597 of a Specification of
the Original of a Printed Matter.

Nov. 30, 1971

R. P. BENEDICT

3,623,367

APPARATUS FOR MEASURING THE AVERAGE TEMPERATURE OF A GAS STREAM

Filed Dec. 23, 1969

